

**METHOD AND APPARATUS FOR MANAGING AUDIO BROADCASTS IN AN  
AUTOMOBILE**

**BACKGROUND OF THE INVENTION**

**1. Technical Field:**

5       The present invention relates generally to an improved data processing system, and in particular, to a method and apparatus for managing audio broadcasts in an automobile.

**2. Description of Related Art:**

10       The use of computers has become more and more pervasive in society. This pervasiveness includes the integration of computers into vehicles. The utilization of computer technology is employed to provide users or drivers with a familiar environment. In this manner, a  
15       user's ability to easily use computing resources in an automobile is provided. Various platforms have been developed and are being developed for use in automobiles. Many platforms provide the computing strength of a personal computer platform with widely recognized as well  
20       as emerging technologies.

      Widely accepted technologies that may be implemented within an automobile include, cellular/global system for mobile communications (GSM), global positioning system (GPS), and radio data broadcast (RDB). These devices  
25       allow a driver to navigate, receive real-time traffic information and weather forecasts, access databases of personalized information, and place and receive telephone calls from an automobile. Emerging technologies that are being integrated into computing platforms for automobiles

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include the universal serial bus (USB) and the digital video disk (DVD).

It is not uncommon for a driver of an automobile to listen to an audio broadcast, such as a news program, and receive a mobile phone call. Many automobiles, which include integration for mobile telephones, include a feature in which the level at which the audio broadcast is presented to the driver is reduced or muted when a call is received. Currently, the driver must decide whether to answer the call and possibly miss important information in the audio broadcast or to ignore the call.

Therefore, it would be advantageous to have an improved method and apparatus for managing audio broadcasts.

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### SUMMARY OF THE INVENTION

The present invention provides a method, apparatus, and computer instructions for controlling presentation of an audio broadcast. Presentation of the audio broadcast is ceased in response to detecting a mobile phone call. 5 The audio broadcast is recorded to form recorded audio presentation data in response to detecting the mobile phone call. The recorded audio presentation data is presented when the mobile phone call ends.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

**Figure 1** is a block diagram of an automotive computing platform in accordance with a preferred embodiment of the present invention;

**Figure 2** is a diagram illustrating data flow in managing audio broadcasts in accordance with a preferred embodiment of the present invention;

**Figure 3** is a diagram illustrating audio data in accordance with a preferred embodiment of the present invention;

**Figure 4** is a diagram illustrating audio controls in accordance with a preferred embodiment of the present invention;

**Figure 5** is a flowchart of a process used for managing presentation of an audio broadcast in accordance with a preferred embodiment of the present invention; and

**Figure 6** is a flowchart of a process used for manually interrupting an audio broadcast in accordance with a preferred embodiment of the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

Turning now to **Figure 1**, a block diagram of an automotive computing platform is depicted in accordance with a preferred embodiment of the present invention.

5 Computing platform **100** is located within a vehicle, such as an automobile or truck. Computing platform **100** includes a CPU **102**, which may be an embedded processor or processor such as a Pentium processor from Intel Corporation. "Pentium" is a trademark of Intel Corporation. Computing platform **100** also includes memory  
10 **104**, which may take the form of random access memory (RAM) and/or read only memory (ROM).

Computing platform **100** also contains a storage device unit **106**. Storage device unit **106** may contain one  
15 or more storage devices, such as, for example, a hard disk drive, or a flash memory. Computing platform **100** also includes an input/output (I/O) unit **108**, which provides connections to various I/O devices. In this example, a GPS receiver **110** is included within computing  
20 platform **100** and receives signals through antenna **112**. Communications are provided through antenna **116**. In addition, car audio unit **118** is connected to I/O unit **108**.

Computing platform **100** also includes a display  
25 adapter **124**, which is connected to display **120**. In the depicted example, this display is a touch screen display. Alternatively, or in addition to a touch screen display, display **120** also may employ a heads-up display projected onto the windshield of the automobile. Computing unit  
30 **100** also includes microphone **126** and speaker system **128**

to provide a driver with an ability to enter commands and receive responses through speech I/O **122** without having to divert the driver's attention away from the road, or without the driver having to remove the driver's hands from the steering wheel. In these examples, car audio unit **118** presents broadcasts through speaker system **128**. This same speaker is used to listen to phone calls received through mobile phone unit **114**.

The illustration of computing unit **100** in **Figure 1** is not intended as an architectural limitation to the present invention, but is an example of one system in which the present invention may be implemented. For example, a computing unit for an automobile may not require a GPS receiver or speech I/O unit to implement the mechanisms of the present invention. Further, in these examples mobile phone unit **114** and car audio unit **118** both use speaker system **128**. Alternatively, different speaker systems may be provided for these two units.

In particular, the present invention provides a method, apparatus, and computer instructions for controlling a live broadcast or audio feed being received by the computing unit. The mechanism of the present invention will store or record an audio broadcast when a mobile phone call is received. The audio broadcast is muted or interrupted when the call occurs. When the call is completed, the driver may begin listening to the audio feed at the point at which the interruption occurred.

Turning next to **Figure 2**, a diagram illustrating data flow in managing audio broadcasts is depicted in accordance with a preferred embodiment of the present invention. This example illustrates components in a

computing unit used to manage the presentation of audio broadcasts and the reception of mobile phone calls.

In this example, CPU 200 controls the presentation of audio broadcast 202 from car audio unit 204 through speaker system 206. Car audio unit 204 and speaker system 206 may be implemented as car audio unit 118 and speaker system 128 in Figure 1. Additionally, CPU 200 also is used to control the presentation of call 208 from mobile phone 210 on speaker system 206. In this example, CPU 200 may be implemented as CPU 102 in Figure 1. However, other types of controllers other than a processor may be used depending on the particular implementation. For example, another type of controller is an application specific integrated circuit.

A broadcast is received by car audio unit 204 and presented on speaker system 206 through CPU 200. When a call is received by mobile phone 210, the presentation of audio broadcast 202 is interrupted, but is not lost. CPU 200 generates audio data 212, which is stored in audio file 214. This audio file is stored in a storage device, such as storage device unit 106 in Figure 1. This storage device also may be an embedded storage device. In addition, time stamp data is stored within audio file 214 for use in synchronizing the stored data with the live broadcast at a later time. The time stamps are generated using real-time clock 216. In this example, real-time clock 216 is located within the automobile but may be obtained from an external source, such as a radio signal received by audio broadcast 202.

After the call is completed, audio data 212 is then presented through speaker system 206 by CPU 200. Audio

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data **212** may be presented through speaker system **206** automatically after the call has completed. Alternatively, the user may initiate the presentation of this data.

5        While the presentation of audio data **212** is being made through speaker system **206**, audio broadcast **202** continues to be stored in audio file **214** until the recorded data is synchronized to the live or real-time stream of data in the audio broadcast. The recorded data  
10 is synchronized to the live broadcast when the data being presented matches the live broadcast. This event or state may be determined using time stamps that are associated with the recorded data. This synchronization is identified by comparing time stamps stored in audio  
15 file **214** to the current time, provided by real-time clock **216**. When audio broadcast **202** is synchronized with audio data **212** then CPU **200** switches to presenting audio broadcast **202** through speaker system **206** and ceases generating audio data **212** from audio broadcast **202**.  
20 CPU **200** also allows a user to manipulate the presentation of audio data **212** through various functions, such as reverse, fast forward, or allowing the user to skip commercials.

      Additionally, CPU **200** also may allow manual  
25 interruption of the presentation of audio broadcast **202** in which audio data **212** is generated for later play back. A function, such as a record button may be used to allow the manual interruption when the user is preoccupied. Additionally, CPU **200** may continue to present audio  
30 broadcast **202** in addition to generation of audio data **212** to allow later play back of selected audio broadcast **202**.



In this example, car audio unit **204** and mobile phone **210** share speaker system **206** with CPU **200** controlling the presentation of audio information.

With reference now to **Figure 3**, a diagram illustrating audio data is depicted in accordance with a preferred embodiment of the present invention. File **300** is an example of audio data stored in an audio file, such as audio file **214** in **Figure 2**. In this example, time stamps **302-316** are stored in association with audio data **318-332**. When the audio data is replayed, these time stamps are examined and compared to the current time to determine whether the presentation of audio data is synchronized with the current audio broadcast.

Turning now to **Figure 4**, a diagram illustrating audio controls is depicted in accordance with a preferred embodiment of the present invention. In this example, the audio controls include stop button **400**, rewind button **402**, play button **404**, fast forward button **406**, and record button **408**. Play button **404** allows audio data to be played. Rewind button **402** and fast forward button **406** allow the user to replay or fast forward through the audio data. Additionally, fast forward button **406** may provide a second function in which commercials are skipped. This second function may be initiated by pressing another key, such as play button **404**, in conjunction with fast forward button **406**. In this example, record button **408** allows for the manual recording of the audio data as described above. Stop button **400** may be used to stop playback or recording of the audio data.

In this example, these buttons may be physical controls in a radio unit or may be presented through a graphical user interface, such as display 120 in **Figure 1**.

5       With reference now to **Figure 5**, a flowchart of a process used for managing presentation of an audio broadcast is depicted in accordance with a preferred embodiment of the present invention. The process illustrated in **Figure 5** may be implemented in a CPU, such as CPU 200 in **Figure 2**.

15       The process begins by monitoring for a mobile phone call (step 500). Next, a determination is made as to whether a call is detected (step 502). If a call is detected, the current audio feed is recorded with time stamps (step 504). The time stamps are generated using a real-time clock in these examples. The presentation of the audio broadcast is interrupted to allow for presentation of the call (step 506). Steps 504 and 506 occur simultaneously in these examples. A determination is made as to whether the call is complete (step 508). If the call is complete, the recorded audio is played (step 510). In this example, the recorded audio is automatically played after the call completes. However, depending on the implementation or user preferences, the recorded audio may be played in response to a user input.

25       Next, a determination is made as to whether the time stamp matches the current time (step 512). If the time stamp does match the current time, the audio feed is no longer recorded (step 514). The live feed is resumed (step 516) with the process terminating thereafter.

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Returning to step **512**, if the time stamp does not match the current time, a determination is made as to whether the user input cancels the audio feed (step **518**).

If the user input cancels the audio feed, the process proceeds to step **514** as described above. If the user input does not cancel the audio feed, the process returns to step **510** as described above.

With reference again to step **508**, if the call is not complete, the process returns to step **506** as described above.

Turning next to **Figure 6**, a flowchart of a process used for manually interrupting an audio broadcast is depicted in accordance with a preferred embodiment of the present invention. The process illustrated in **Figure 6** may be implemented in a CPU, such as CPU **200** in **Figure 2**.

The process begins by receiving a manual interrupt command (step **600**). After receiving the manual interrupt command, the audio is recorded with time stamps (step **602**). The audio is interrupted (step **604**). Step **602** and step **604** basically occur at the same time. Next, a determination is made as to whether a command to cancel the manual interrupt has been received (step **606**). The manual interrupt may be cancelled by a user input, such as the selection of a stop button. If the manual interrupt is not cancelled, the process continues to return to step **606**.

Upon receiving a command to cancel the manual interrupt, the recorded audio data is played (step **608**). In this example, the audio data is played after the stop button is pressed. Alternatively, the audio data may be

presented in response to another user input, such as the selection of a play button.

A determination is then made as to whether the time stamp matches the current time (step **610**). If the time stamp matches the current time, the audio feed stops recording (step **612**). The live feed is then resumed (step **614**) with the process terminating thereafter.

Turning again to step **610**, if the time stamp does not match the current time, a determination is made as to whether a user input is received that cancels the audio feed (step **616**). This cancellation is the selection of the stop button in these examples. If the user input cancels the audio feed, the process proceeds to step **614** as described above. If the user input does not cancel the audio feed, the process returns to step **608** as described above.

Thus, the present invention provides an improved method, apparatus, and computer instructions for managing presentation of audio broadcasts and mobile phone calls. The mechanism of the present invention allows for a user to receive a mobile phone call while a broadcast is occurring. Upon receipt of the call, the presentation of the broadcast is interrupted to allow the mobile phone call to be presented. To prevent the user from missing the broadcast that occurs while the mobile phone call is in progress, the broadcast is recorded. This recorded broadcast is replayed to the user after the mobile phone call terminates. The real-time stream of the audio broadcast is presented to the user when that data is synchronized with the data stored from the broadcast. This synchronization is performed in these examples using time stamps. Thus, with this mechanism, the user does

not have to miss an audio broadcast to answer a mobile phone call. With a manual interrupt, as described above, the user also may avoid missing audio broadcasts in response to other distractions.

5       It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in  
10 the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media  
15 include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example,  
20 radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

      The description of the present invention has been  
25 presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in  
30 order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for

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various embodiments with various modifications as are suited to the particular use contemplated.

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